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EXAMINER
CHAN, ALEX H

ART UNIT	PAPER NUMBER
2633	2

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Please find below and/or attached an Office communication concerning this application or proceeding.

		Application No.	Applicant(s)
Office Action Summary		09/845,557	SPICKERMANN, RALPH
		Examiner	Art Unit
		Alex H Chan	2633

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>30 April 2001</u>.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>1-20</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) <u>1-20</u> is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on <u>30 April 2001</u> is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

    a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.

4) ☐ Interview Summary (PTO-413) Paper No(s). _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2.   **Claims 1-5, 8-18** are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S.

Patent No, 6,388,786 B1 to Ono et al (hereinafter Ono) in view of U.S. Patent No. 6,424,444 B1

to Kahn et al (hereinafter Kahn), and further in view of U.S. Patent No. 6,389,081 b1 to Shimizu

et al (hereinafter Shimizu) or in view of U.S. Patent No. 5,222,103 to Gross et al (hereinafter

Gross).

Regarding claim 1, Ono discloses a transmitter laser (*1 of Fig. 13, Ono*) for providing a

laser beam; an amplitude modulator (*2 of Fig. 23, Ono*) for amplitude modulating the laser beam;

an optical fiber (*e.g. fiber connected between 1 and 2 of Fig. 23, Ono*) for coupling the laser

beam to the amplitude modulator; a phase modulator (*3 of Fig. 23, Ono*) in series with the

amplitude modulator for phase modulating the amplitude modulated laser beam; an optical fiber

(*e.g. fiber connected between 2 and 3 of Fig. 23, Ono*) coupled between the amplitude modulator

and the phase modulator; and an electrical delay (*9 of Fig. 23, Ono*) for synchronizing (*Fig. 10A-

10D, Ono*) the arrival of the amplitude modulated light at the phase modulator (*Col. 7, lines 13-

30, Ono*) with a signal from a phase angle portion of the constellation generating apparatus

arriving at the phase modulator. He does not explicitly disclose a programmable system for

transmitting an arbitrary M-ary modulated optical signals.

Kahn discloses a programmable system for transmitting an arbitrary M-ary modulated

(*e.g. information bits are encoded in a M-ary pulse-amplitude-modulation symbol sequence,*

abstract and Fig. 6c, Kahn) optical signal. Accordingly, one of the ordinary would have been

motivated to employ a programmable system for transmitting an arbitrary M-ary modulated

signal to narrow the optical spectrum and lengthen the symbol interval of the transmitted signal

as compared to on-off keying (*Col. 2, lines 24-29*). Therefore, it would have been obvious to one

of artisan from the same endeavor at the time the invention was made to modify the method for

generating duobinary signal of Ono by incorporating a programmable system for transmitting an

arbitrary M-ary modulated signal because this narrow the optical spectrum and lengthen the

symbol interval of the transmitted signal.

Though Ono in view of Kahn discloses the data points (*e.g.* $|s(t)|$ *and sgn[s(t)] of Fig. 6c,*

Kahn) are split into the amplitude (*via 277, 285 and 286 of Fig. 6c, Kahn*) and phase modulator

(*via 281, 291 and 292 of Fig. 6c, Kahn*) to amplitude and phase modulate the laser beam, Ono in

view of Kahn does not explicitly disclose a constellation generating apparatus that is responsive

to input data and a data modulator clock signal for generating a constellation of data points.

Shimizu discloses a constellation generating apparatus (*e.g. via 40 of Fig. 6A and Col. 7,*

lines 14-28) that is responsive to input data (*data signal of Fig. 6A*) and a data modulator clock

signal (*clock signal of Fig. 6A*) for generating a constellation of data points (*Fig. 4 and 7*).

Likewise, Gross discloses a constellation generating apparatus (*e.g. via 12 and 22 of Fig.*

1) that is responsive to input data (S_0 *and* S_1 *of Fig. 1*) and a data modulator (*22 of Fig. 1*) clock

signal (*via 24 of Fig. 1*) for generating a constellation of data points (*Fig. 2A and 2B and 7*).

Accordingly, one of the ordinary skill in the art would have been motivated to employ a

constellation generating apparatus for providing bandwidth efficient modulation techniques that

are used to maximize the amount of information transmitted across fiber optic link in which

spectral bandwidth required for the transmission of each such digital data channel is reduced

(*Col. 1, lines 9-15*). Therefore, it would have been obvious to one of ordinary skill in the art at

the time the invention was made to modify the method for generating duobinary signal of Ono in

view of Kahn by incorporating a constellation generating apparatus because this provides

bandwidth efficient modulation techniques as suggested by Gross.

Regarding claim 2, Ono discloses that the electrical delay comprises a length of coaxial

cable (*e.g. Col. 1, lines 18-21 and Col. 11, lines 7-11*). Also, since the delay circuit is electrical,

it would have been a matter of design choice to employ a length of coaxial cable (*or any other*

electrical cables). This support rational is based on a recognition that the claimed differences

exist not as a result of an attempt by applicant to solve a problem but merely amounts to

selection of expedient known to the artisan of ordinary skill as design choice.

Regarding claims 3 and 14-15, Ono in view of Kahn and Gross discloses amplitude

symbol mapping logic (*e.g. via 7 and 39 of Fig. 18, Col. 4, line 61-Col. 5, line 6 and Col. 9, line*

37-Col. 10, line 33, Ono or via 371 of Fig. 9c, Col. 22, line 54-Col. 23, line 30 and Col. 24, line

26-Col. 25, line 9, Kahn or via 12 of Fig. 1, Gross) that is responsive (*and therefore adaptable*) to input data (*6 of Fig. 22, Ono or X_1 and X_2 of Fig. 9c, Kahn or S_0 and S_1 of Fig. 1, Gross*) and a data clock signal (*24 of Fig. 22, Ono or 24 of Fig. 1, Gross*), weighting apparatus (inside *7 and 25 of Fig. 22, Ono or 230a of Fig. 9c, Kahn, or 12 and 22 of Fig. 1, Gross*), summing apparatus (*e.g. inside 25 of Fig. 22, Ono, 244 of Fig. 5c, Kahn or via 40 of Fig. 3, Gross*) and amplifying apparatus (*70 of Fig. 27, Ono or 44 of Fig. 3 and Col. 10, lines 31-42 and Col. 3, line 12-18, Gross,*).

Regarding claims 4 and 16-17, Ono in view of Kahn and Gross discloses phase angle symbol mapping (*e.g. mapping to three level, Fig. 19 and via 25 of Fig. 17, Ono or Fig. 2A-2B and via 12 of Fig. 1, Gross*) logic (*e.g. Fig. 21 or 25 of Fig. 17, Col. 1, lines 21-25 and lines 38-65, Ono via 12 of Fig. 1, Gross*) that is responsive (*and therefore adaptable*) to input data (*6 of Fig. 17 or data of Fig. 21, Ono or S0 and S1 of Fig. 1, Gross*) and a data clock signal (*24 of Fig. 17 or CLK of Fig. 21, Ono or via 24 of Fig. 1, Gross*), weighting apparatus (inside *7 and 25 of Fig. 22, Ono or 22 of Fig. 1, Gross*), summing apparatus (*e.g. inside 25 of Fig. 22, Ono, 244 of Fig. 5c, Kahn or via 40 of Fig. 3, Gross*), amplifying apparatus (*70 of Fig. 27, Ono or 44 of Fig. 3 and Col. 10, lines 31-42 and Col. 3, line 12-18, Gross,*), and delaying apparatus (*9 of Fig. 23, Ono, or via 239 of Fig. 9c, Kahn or 22 ("T") of Fig. 1, Gross*).

Regarding claim 5, Ono in view of Kahn and Gross discloses the modulation format of

the optical signal of an optical link is reconfigured to maximize data transmission for a varying

allowed bit error rate (*e.g. by using error-correction coder or Gray coding, Col. 7, lines 16-23

and Col. 15, lines 10-15, Kahn or Fig. 9, Gross*) and varying available link optical dynamic

range (*Fig. 24a and Col. 7, lines 31-45 and Col. 10, lines 47-49, Ono or Fig. 11, Kahn or Fig. 5,

Gross*).

Regarding claim 8, Ono in view of Kahn and Gross discloses that the system

compensates for performance variations in the components of a communication link (*Col. 33,

lines 34-51, Kahn or bit error rate, Fig. 9 and Col. 10, lines 9-30, Gross*).

Regarding claim 9, the limitations introduced by claim 9 correspond to the limitations

introduced by claim 1. The treatment of claim 1 above reads on the corresponding limitations of

claim 9.

Regarding claim 10, Ono in view of Kahn and Shimizu discloses the constellation of

data points comprises a Grey code (*Col. 3, lines 50-65, Kahn or Col. 6, lines 20-21, Shimizu*).

Regarding claim 11, Ono in view of Kahn and Shimizu or Gross discloses all limitations as discussed above, and further discloses constellation generating apparatus (*e.g. via 12 and 22 of Fig. 1, Gross or via 40 of Fig. 6A and Col. 7, lines 14-28, Shimizu*) for generating a amplitude control signal (*40a and 40b of Fig. 18, Ono, $|s(t)|$ of Fig. 9c, Kahn, $26_1...26_N$ of Fig. 3, Gross when applying to intensity modulated system using optical modulator, Col. 1, lines 49-58 and Col. 3, lines 12-18, or via amplitude modulation, Col. 1, lines 36-38, Shimizu*) and a phase control signal (*8 of Fig. 17, Ono or sgn[s(t)] of Fig. 9c, Kahn, or $26_1...26_N$ of Fig. 3, Gross or via phase modulation, Col. 1, lines 36-38, Shimizu*) from an input data signal, the amplitude control signal input to the amplitude modulator (*e.g. 40a and 40b input to 38a and 38b of Fig. 17, Ono or $|s(t)|$ inputs to 381 of Fig. 10a, Kahn*) and the phase control signal input to the phase modulator (*e.g. 8 inputs to 3 of Fig. 17, Ono or sgn[s(t)] inputs to 386 of Fig. 10a, Kahn*), together the amplitude control signal and the phase control signal representing a constellation of data points (*e.g. in accordance with amplitude and phase in Fig. 3 and Fig. 10, Ono, phase in Fig. 7a-h and amplitude voltage in Fig. 8a-i, Kahn or logic levels in Fig. 2A-2B and Fig. 7, Gross or I_{ch} and Q_{ch} of Fig. 7, Shimizu*) such that the amplitude and phase modulated optical signal is an arbitrary M-ary modulated optical signal (*e.g. information bits are encoded in a M-ary pulse-amplitude-modulation symbol sequence, abstract, Kahn*).

Regarding claim 12, Ono discloses the amplitude modulator modulates the optical signal before the phase modulator modulates the optical signal (*2 modulates the optical signal before 3 of Fig. 8 or 3 modulates the optical signal before 2 of Fig. 13*) and the system further comprising

a delay (*9 of Fig. 8*), the delay delaying the phase control signal to synchronize the phase

modulation of the optical signal with a delay between the amplitude modulator and the phase

modulator (*Col. 7, lines 22-30*).

Regarding claim 18, the limitations introduced by claim 18 correspond to the limitations

introduced by claim 5. The treatment of claim 5 above reads on the corresponding limitations of

claim 18.

3.   **Claims 6-7 and 19-20** are rejected under 35 U.S.C. 103(a) as being unpatentable over

Ono in view of Kahn and Shimizu or Gross as applied to claim 1 above, and further in view of

U.S. Pub. 20030012289 A1 to Lindoff.

Regarding claims 6-7, Ono in view of Kahn and Shimizu or Gross does not disclose that

the system predistorts the transmitted constellation to compensate for nonlinearity in the optical

link or self-phase modulation. Lindoff discloses the system predistorts (*via 404 and 405 of Fig.

4A and 420 and 430 of Fig. 4C*) the transmitted constellation (*Fig. 4B and 5B*). One of the

ordinary would have been motivated to employ a system which predistorts the transmitted

constellation so as to reduce the bandwidth of a signal while retaining the desired signal

information and satisfying system requirement [*paragraph 0001*] (*e.g. such as nonlinearity and

self phase modulation (SPM) as known in the art*). Therefore, it would have been obvious to one

of ordinary skill in the art at the time the invention was made to modify the method for

generating duobinary signal of Ono in view of Kahn and Shimizu or Gross by predistorting the

transmitted constellation because this helps to retain the desired signal information and satisfy

system requirement.

Regarding claim 19, Ono in view of Kahn and Lindoff discloses that constellation

generating apparatus is reconfigured to generate respective amplitude control (r_t *of Fig. 5A,*

Lindoff) and phase control signals (φ_t *of Fig. 5A, Lindoff*) to produce a predistorted optical signal

(*via polar modulator, Lindoff or via 2 and 3 of Fig. 8, Ono or 381 and 386 of Fig. 10a, Kahn*).

Regarding claim 20, the limitations introduced by claim 20 correspond to the limitations

introduced by claims 6-7. The treatment of claims 6-7 above reads on the corresponding

limitations of claim 20.

Conclusion

4.   The prior art made of record and not relied upon is considered pertinent to applicant's

disclosure. Kavehard et al is cited to show weighting and summing apparatus with varying rate

codes using amplitude-modulated and quadrature-amplitude-modulated signals and its related

signal to noise ratio and dynamic range (Fig. 1, 3, Fig. 4-13). Machida et al is cited to show

QAM which are the typical constellations for 16 APSK and its SNR (Fig. 1a and 1b, Fig. 2-3).

Anderson is cited to show constellation with 16 symbols and its weighting and summing apparatus (Fig. 5A-5B and Col. 1, lines 24-28). Dent is cited to show OPQSK modulation and its constellation relating to amplitude and phase (Fig. 3 and 5). Bergano is cited to show a data modulator (can also be amplitude modulator) and phase modulator having variable delay responsive to data and clock signals (Fig. 1). Beylat et al is cited to show weighting and summing apparatus in a adaptable phase modulator (Fig. 2 and 3). Takahara et al is cited to show Gray coding and its related SNR. Bergano et al is cited to show dispersion compensation (Fig. 7-10). Nakamoto is cited to show a weighting apparatus (abstract). Huber is cited to show a similar claimed structure comprising optical modulator, delay, clock and data input (Fig. 2). Lou et al is cited to show amplitude mapping logic, rate code and voltage and SNR correspondence (Fig. 4-9).

5.   Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alex H Chan whose telephone number is (703) 305-0340. The examiner can normally be reached on Monday to Friday (8am to 6pm EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on (703) 305-4729. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9314.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

Alex Chan
Patent Examiner, AU 2633
January 2nd, 2004

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